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Implementation of Decision Support in Mutual Fund Investment Selection using MOORA

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ABSTRACT

This research focuses on the application of the Multi-Objective Optimization method based on Ratio Analysis (MOORA) as part of the Decision Support System (DSS) in the selection of mutual fund investments in Indonesia. The purpose of this study is to help novice investors who often find it difficult to choose mutual funds due to lack of knowledge. Considering that the number of investors continues to increase, especially during and after the pandemic, this research becomes relevant and important. The MOORA method was chosen because of its ease and flexibility in handling various criteria compared to other Multiple Criteria Decision Making (MCDM) methods. The five criteria taken as calculation material are return, risk, cost, liquidity, and reputation of the investment manager. The results showed that the MOORA method is effective in providing objective and data-driven investment recommendations. Considering various relevant criteria and weights, MOORA can provide mutual fund ratings that match investors' preferences and risk tolerance. Thus, this research successfully achieved its goal of assisting novice investors in choosing mutual funds. These results suggest that MOORA can be an important part of DSS in the context of mutual fund investing.

Keywords: MOORA; Mutual Fund; MCDM

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1. INTRODUCTION

Mutual funds are investment instruments that collect funds from investors to be managed by investment managers in the form of portfolios. This portfolio can contain different types of investment assets, such as stocks, bonds, or money market instruments, depending on the fund's investment goals and strategies [1]. Each investor in a mutual fund has a unit of inclusion that represents their share of the total assets in the portfolio. Investment profits are divided according to the number of participation units owned by each investor. Mutual funds give individual investors access to invest in diversified, professionally managed portfolios that may be difficult or expensive to create on their own [2]. In addition, mutual funds also provide liquidity, because participation units can be bought or resold to investment managers on each exchange day.

In today's digital era, mutual fund investment has become one of the most popular investment choices in Indonesia. Mutual funds offer various advantages such as high liquidity, risk diversification, and attractive profit potential. However, choosing the right mutual fund can be a challenge for novice investors [3]. This is due to the lack of knowledge about mutual funds and the complexity of the information available. This situation is exacerbated by pandemic and post-pandemic conditions which show an increase in the number of investors

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[4], [5]. Therefore, an objective and systematic approach is needed in the selection of mutual funds so that objective decision making can be made but does not make it difficult for novice investors [6], [7].

Multi-Criteria Decision Making (MCDM) is a method used to solve decision-making problems involving many criteria or objectives [8]. MCDM helps decision makers to choose the best alternative from a number of available alternatives based on predetermined criteria [8], [9]. In the context of investment, MCDM can be used to select the best investment instruments based on criteria such as return, risk, liquidity, and others. MCDM has various methods, including Analytic Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and Multi-Objective Optimization on the basis of Ratio Analysis (MOORA) [10]. Each method has its own advantages and disadvantages, and the choice of method depends on the context and needs of the decision maker.

The MOORA (Multi-Objective Optimization based on Ratio Analysis) method was chosen in this study for several reasons. This method offers several advantages compared to other MCDM methods. First, MOORA can capture various features such as criteria and alternatives in evaluating multi-criteria decision-making problems. This is important because multi-criteria decision-making problems often involve information that cannot be directly measured [11]. Secondly, MOORA offers a stable and well-structured analytical framework for ranking alternatives [12]. This contrasts with some other MCDM methods that show instability in alternative ratings, such as TOPSIS or ELECTRE. Finally, MOORA allows for easier determination of criteria weights compared to some other MCDM methods. This can facilitate the decision-making process, especially in situations where weighting criteria becomes challenging. MOORA has been used in a variety of applications, including performance appraisal, supplier selection, and strategic planning. One of the advantages of MOORA is its ability to handle different types of data, including quantitative and qualitative data, as well as uncertain or vague data. With these advantages, MOORA is the right choice to be used in this research. The use of MOORA is expected to provide objective recommendations and in accordance with investor preferences in choosing mutual funds [12].

In this study, five criteria were selected in the selection of mutual funds, namely the first is *return*. This criterion was chosen because return is the main indicator of investment success. Investors certainly want a high return on their investment [13]. While the second criterion is *risk* which is an important consideration in investment [6]. Beginner investors are usually more risk-averse, so mutual funds with low risk are an attractive choice. While the third criterion is *cost* which is also an important consideration in investment. High costs can reduce investment returns. Next is the liquidity criterion which shows how easily the investment can be sold. Mutual funds with high liquidity are certainly more attractive to investors. And the last is *the reputation of the investment manager* which can be an indicator of the quality of investment management [3]. Experienced and reputable investment managers are certainly more trusted in managing investments.

Based on this description, the purpose of this study is to obtain a mutual fund investment ranking that can be used as a reference by novice investors in choosing mutual funds. By using the MOORA method, it is expected to provide recommendations that are objective and in accordance with investor preferences. In addition, with the convenience offered by MOORA, both in determining criteria and in the calculation process, novice investors who are indeed in the lay category, can still use the research results by making modifications easily based on their respective preferences.

2. RESEARCH METHODS

MOORA is an MCDM method that optimizes the ratio of each alternative to each criterion. MOORA has two main steps: normalization and assessment. In normalization, each criterion value is converted into the ratio of the criterion value to the square root of the sum of the squares of all criterion values. In scoring, these values are then combined to produce a score for each alternative. Here are the general steps in the MOORA method:

1. **Formation of Decision Matrix**: A decision matrix is created with alternatives as rows and criteria as columns. Each cell in the matrix contains a value from an alternative on a specific criterion.
2. **Decision Matrix Normalization**: Each value in the decision matrix is normalized by dividing that value by the square root of the sum of the squares of all values in the same column. This results in a normalized matrix, in which each column has a vector length of 1.

$$Xij = \begin{matrix} X11 & X12 & .. & X1n \\ X21 & X22 & .. & X2n \\ .. & .. & .. & .. \\ Xm1 & Xm2 & .. & Xmn \end{matrix}$$

3. **Weighting Criteria**: Each criterion is weighted based on importance relative to other criteria. This weight is usually determined by the decision maker.

$$x_{ij}^* = X_{ij} / \sqrt{\left[\sum_{i=1}^m x_{ij}^2\right]}$$

4. **Score Calculation**: The score for each alternative is calculated by multiplying the normalized value by the corresponding weight, and then summing the results for all criteria. This generates a total score for each alternative.

$$Yi = \sum_{j=1}^g w_j x_{ij}^* - \sum_{j=g+1}^n w_j x_{ij}^*$$

5. **Alternative Ranking**: Alternatives are then ranked based on their total score, with the alternative that has the highest score considered the best alternative.

3.   RESULTS AND DISCUSSION

In this study, five criteria have been determined for mutual fund evaluation, namely return, risk, cost, liquidity, and reputation of the investment manager. The weights for each criterion are determined based on expert opinion and investment logic.

3.1. Criterion Weighting for Mutual Fund

1. **Return:** Return on investment is a key indication of investment performance. The greater the rate of return, the better the investment. As a result, return was given the most weight in the analysis. This weighting is based on professional opinion and investment logic that the most essential criterion in selecting a mutual fund is return [14].

2. **Risk:** Another key aspect of investment is risk. Beginner investors are typically risk-averse, thus low-risk mutual funds are an appealing option. As a result, risk was assigned the second greatest weight in the study. This weighting is based on professional opinion and investment logic that risk is a significant consideration when selecting a mutual fund. [14], [15].

3. **Cost:** Cost is another key factor to consider when investing. Investment returns might be reduced by high costs. As a result, cost was assigned the third greatest weight in the study. This weighting is based on professional opinion and investment reasoning that cost is a significant consideration when selecting a mutual fund [1], [16].

4. **Liquidity**: The ease with which an investment can be sold is referred to as its liquidity. Investors are more likely to purchase mutual funds that have significant liquidity in their respective markets. As a result, the amount of available liquid assets received the fourth greatest weight in the analysis. This weighting is based on the view of investing professionals and the logic of investments, which state that liquidity is an important feature to consider when selecting mutual funds [17], [18].

5. **Investment Manager Reputation**: It is possible that the quality of an investment manager's reputation can serve as an indicator of the quality of the investment management provided. When it comes to managing money, one should almost always defer more trust to experienced and trustworthy financial managers. As a result, the study places the sixth highest weight on factors related to the reputation of the fund management. This weighting is based on the judgment of investment professionals and investing logic that the reputation of an investment manager is a significant consideration to consider when selecting a mutual fund [2].

After the weights have been defined, the MOORA approach is applied to the process of calculating a score for each mutual fund based on the criteria and weights that were previously established. Following that, this score is utilized to rate the various mutual funds [20].

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3.2. Discussion

The results of this study show that the MOORA method can be used effectively to select mutual funds. By using MOORA, novice investors can make more data-driven and objective investment decisions. Here is a simulation of MOORA completion assuming predetermined weights and values. Assume there are 5 choices of mutual funds (A to E) with criteria values with a scale between 55-100 for each criterion. In this simulation, the weight given reflects the importance of each criterion in the decision-making process. Risk is given the highest weight because it is the most important factor for novice investors. The reputation of the investment manager is also given a high weight because it can be an indicator of the quality of investment management. Returns, fees, and liquidity are given equal weight because they are all important in choosing mutual funds. Using the MOORA method, investors can choose the mutual fund that best suits their preferences based on predetermined criteria. This method also allows investors to consider different aspects of investing simultaneously, to make better and more data-driven decisions.

Step 1: Formation of the Decision Matrix

Here is a simulation of MOORA completion assuming predetermined weights and values. Let's assume there are 5 mutual fund options (A to E) with values between 55-100 for each criterion. Each mutual fund is disguised into a letter of the alphabet so that there is no conflict of interest at the time of calculation. While the value given is based on research conducted through two applications, namely BIBIT and BAREKSA for mutual funds with stock types and fixed income.

Table 1. Weight of Each Criterion

Fund	Return	Risk	Cost	Liquidity	Investment Manager Reputation
A	80	70	90	85	75
B	85	65	95	80	80
C	90	60	100	75	85
D	95	55	85	70	90
E	100	50	80	65	95

Step 2: Normalize the Decision Matrix

Each value in a column is divided by the square root of the sum of the squares of all the other values in that column during normalization. Next, normalization is carried out. Each value in a column is divided by the square root of the sum of the squares of all the other values in that column during normalization. Next, normalization is carried out. The normalization calculation looks like table 2, after computing the square root of the sum of the squares of all the values in each column, we then divide each value in the column by the square root that we just calculated:

Table 2. Normalization

Fund	Normalization				
	Return	Risk	Cost	Liquidity	Investment Manager Reputation
A	0.396301924	0.518163247	0.445839664	0.504604351	0.393241879
B	0.421070794	0.481151587	0.470608534	0.474921742	0.419458004
C	0.445839664	0.444139926	0.495377405	0.445239133	0.445674129
D	0.470608534	0.407128266	0.421070794	0.415556524	0.471890255
E	0.495377405	0.370116605	0.396301924	0.385873915	0.49810638

After normalizing, we get a normalized decision matrix. This matrix will be used in the next step to calculate the score for each mutual fund.

Step 3: Weighting the Criteria

After normalizing, the next step is to give weight to each criterion. Giving weight to each of these criteria is based on literature search that in the selection of mutual funds is very concerned about the reputation of the investment manager (including its history) and the risks that must be borne by novice investors. Because many novice investors do not have a strong understanding at the beginning of investing. As for return, cost and liquidity have the same score assuming that mutual fund investments are generally not for short-term interests and are more in the form of medium-term and long-term savings, so profit is not the main goal for novice investors, as well as liquidity that is more concerned with short-term movements becomes less important than risk weighting. This weight reflects how important the criteria are in the decision-making process. In this case, the weights for each criterion are as follows:

1.   Return: 15%
2.   Risk: 25%
3.   Cost: 15%
4.   Liquidity: 15%
5.   Investment Manager Reputation: 30%

Step 4: Score Calculation

After multiplying the normalized value by the corresponding weighting, the total score for each mutual fund is determined by adding the scores for each component and then summing them. We can calculate a score for each mutual fund after assigning a weight to each criterion. This score is calculated by multiplying the normalized value by the corresponding weight and then summing the individual values for each criterion. Following is the calculation:

Table 3. Score Calculation

Fund	Result					Results
	Return	Risk	Cost	Liquidity	Investment Manager Reputation	
Type	benefit	benefit	benefit	benefit	benefit	
Weight	**0.15**	**0.25**	**0.15**	**0.15**	**0.3**	
A	0.059	0.130	0.067	0.076	0.118	0.450
B	0.063	0.120	0.071	0.071	0.126	0.451
C	0.067	0.111	0.074	0.067	0.134	0.453
D	0.071	0.102	0.063	0.062	0.142	0.439
E	0.074	0.093	0.059	0.058	0.149	0.434

Step 5: Ranking Alternatives

Following the completion of the scoring calculation for each mutual fund, we can rank the funds according to the sum of their scores. It is generally agreed that the best mutual fund is the one that ends up with the highest total score. Imagine that after conducting the calculations, we get the following result for the overall score:

Table 4. Total Results

Fund	Total
A	0.450
B	0.451
C	0.453
D	0.439
E	0.434

With this total score, we can rank each mutual fund as follows:

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1.   Mutual Fund C
2.   Mutual Fund B
3.   Mutual Fund A
4.   Mutual Fund D
5.   Mutual Fund E

When we have completed computing a score for each individual mutual fund, we may arrange the funds in decreasing order based on the sum of their scores. It is widely assumed that the mutual fund with the greatest total score is the one that should be deemed the best. Assume that after the computations, we arrive at the following conclusion about the total score, that the mutual fund with the highest score is the mutual fund that is considered the most eligible to be invested by novice investors. However, due to the nature of the DSS which only provides advice, the final decision remains in the hands of investors.

4.   CONCLUSION

Through the application of the MOORA approach, this study intends to assist new investors in making decisions regarding mutual funds in Indonesia. This research was successful in establishing an objective and data-based assessment of mutual funds by considering five essential investment characteristics, namely performance, risk, cost, liquidity, and reputation of investment managers.

The findings demonstrated that the MOORA approach could be an efficient tool for facilitating the process of investment decision making. MOORA can make suggestions that are in line with the preferences of investors by considering a variety of important criteria and weights. In addition, investors can think about multiple facets of investing all at once with the help of this strategy, which enables them to come to judgments that are superior and more based on evidence. According to the findings of this research, one of the most essential things for investors to take into consideration when choosing between different mutual funds is the return, risk, cost, liquidity, and reputation of the investment managers. Investors can select the mutual fund that caters to their tastes and level of risk tolerance the most effectively by taking these variables into consideration.

The major purpose of the study, which was to act as a guide for inexperienced investors in the selection of mutual funds, was successfully accomplished to a significant degree by the research. By adopting the MOORA strategy, investors can make investment decisions that are more data-driven and objective, which eventually results in an increase in the prospective returns and a reduction in investment risk. But further testing is still needed to prove that the results of this method can be applied in the real world.

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